UNSUPERVISED CLASSIFICATION OF SEDIMENTS IN 'DE IJZERMONDING'

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'De IJzermonding' is a nature reserve at the Belgian coast consisting of intertidal mudflats, marshes and dunes. Since erodibility of intertidal flats is dependent on the biophysical characteristics of sediments, it is vital to detect sediment properties. However, mudflats are often large and inaccessible areas, leading to dangerous and time-consuming field campaigns. Airborne hyperspectral remote sensing overcomes this problem by deriving detailed information on a regional scale.

A hyperspectral Compact Airborne Spectrographic Imager (CASI) image of the reserve acquired in 2003 was used to categorize the sediments by unsupervised classification. Principal component analysis (PCA) followed by hard and fuzzy clustering techniques were utilized. PCA reduces redundancies in datasets, i.e. in the hyperspectral image. Previous research has indicated the usefulness of PCA, but clustering of pixels remained arbitrarily using the first two principal components (PCs) and mean values of the dataset (Adam, 2004). Therefore, objective clustering techniques were assessed.

Kmean hard clustering and Gustafson-Kessel fuzzy clustering algorithms were performed on different combinations of PCs to classify features in the image. Furthermore, three scenarios were considered. In the first scenario, water was masked to reduce the spectral variability of the dataset. Results revealed undesirable emphasis on vegetation and sand partitioning due to their dominant reflectance. Since sediment characterization was the main interest, water and vegetation were masked leading to the second scenario. This resulted in further distinction between sand, mixed sediment, and mud types. Yet, emphasis was still mainly on sand due to its characteristic reflectance in the infrared range. So finally, in the third scenario, along with water and vegetation masking, only the bands in the visible light were used to calculate the PCs. Distinction between sand, mixed sediments and mud amplified considerably. These preliminary results look promising, and in the future, the results will be validated and accuracies assessed. The results will be building blocks for erodibility prediction and evolution.

References

Adam S. 2004. Characterization of intertidal mudflats using hyperspectral remote sensing – Case Study: 'De IJzermonding'. Master's Dissertation. KULeuven and Purdue University.